Development and verification of SCIAMACHY operational ESA Level 2 version 6/7 products

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Introduction/Objective

The SCIAMACHY Quality Working Group (SQWG), formed in 2007, aims at improving the quality of the operational SCIAMACHY data products. University of Bremen (UB-IUP), Belgian Institute for Space Aeronomy (IASB-BIRA), Remote Sensing Technology Institute, German Aerospace Center (IMF-DLR), Netherlands Institute for Space Research (SRON) and Royal Netherlands Meteorological Institute (KNMI) are the members providing expertise in this group. Since the establishment of SQWG, the ESA operational Level 2 processor was significantly improved w.r.t. data quality and the product list was substantially enhanced with new parameters.

The SQWG Level 2 team is working on the improvement and implementation of processor Version 6 (V6) and the future Version 7 (V7) ensuring good quality data products, long-term data usability as well their availability in a standard format.

The operational Level 2 (L2) V6 contains nadir aerosol absorbing index, total columns O_3, NO_2, BrO, SO_2, OClO, HCHO, CHOCHO, H_2O, CO/xCO, xCH_4, and improved cloud parameters over snow and ice and in limb O_3 (extended to upper Statosphere and lower Mesosphere) , NO_2, BrO profiles and limb cloud flagging scheme for Noctilucent clouds.

The operational L2 V7 is planned to include toal column IO, Tropospheric O_3 and NO_2 from limb-nadir matching, Tropospheric BrO and HCHO, improved limb cloud detection scheme with clouds/aerosol discrimination and feasibility studies on UTLS water vapor profiles in addition.

Summary Current L2 Activities

L2 Continued

- **L2 Error calculation** (DLR-IMF)
- **Limb aerosols** (IUP, scientific product)
- **O_3 total columns** (BIRA)
- **Tropospheric NO_2 columns** (IUP)
- **Maintainance Reference Products** (IUP)

L2 new

- **Limb cloud flagging** (IUP)
- **Tropospheric O_3 columns** (IUP)
- **Limb water vapor profiles** (IUP)
- **Troposheric BrO columns** (BIRA-IASB)
- **Nadir IO total columns** (IUP)
- **Link to follow-on sensors** (IUP)

Data Processing and Availability

The Level 1b (L1b) Version 8 (V8) dataset (for the L2 V6) is reprocessed for the full SCIAMACHY mission 2002-2012 at the Data Processing and Analysis Consortium (DPAC) and will be released during 2015. The L2 V6 processing is currently in preparation. The L2 diagnostic datasets (DDS) is processed and is available for the SQWG experts/validation teams only for verification. The expected release for the full reprocessed L2 V6 (SCI_OL__2PY) dataset is in 2015.

The next L1b V8 for L2 V7 is planned to be released in 2017.

Highlights

Examples New Operational L2 Products processing and initial verification

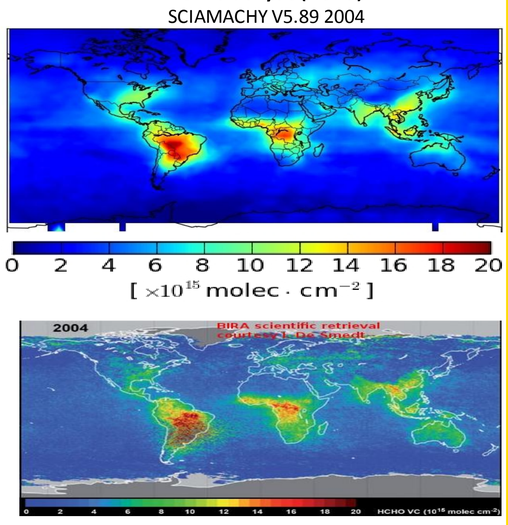
Formaldehyde (HCHO)

SCIAMACHY V5.89 2004

Formaldehyde, HCHO total columns based on BIRA-IASB retrieval is implemented in the operational processor and verified.

Example shows the verification of the SPG V5.89 (upper panel) with the scientific product of BIRA-IASB (lower panel).

All source regions are perfectly captured showing very good agreement with the BIRA's scientific product.



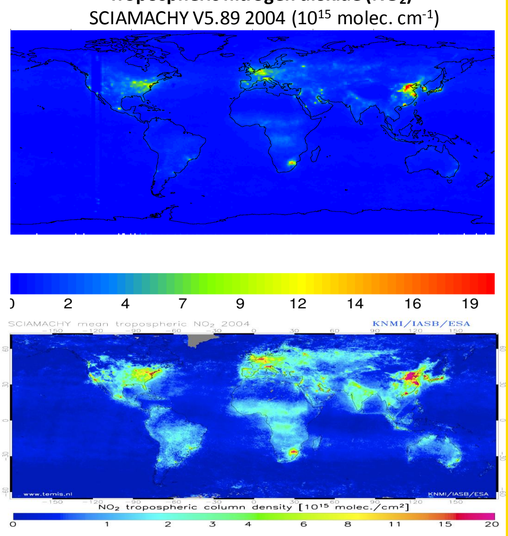
Tropospheric nitrogen dioxide (NO_2)

SCIAMACHY V5.89 2004 (10^{15} molec. cm^{-1})

Tropospheric nitrogen dioxide, NO_2 columns based on UB-IUP retrieval from Limb-nadir matching is implemented in the operational processor and verified.

Example shows the verification of the SPG V5.89 (upper panel) with the scientific product of BIRA-IASB (lower panel).

Results show very good agreement with the BIRA's scientific product.



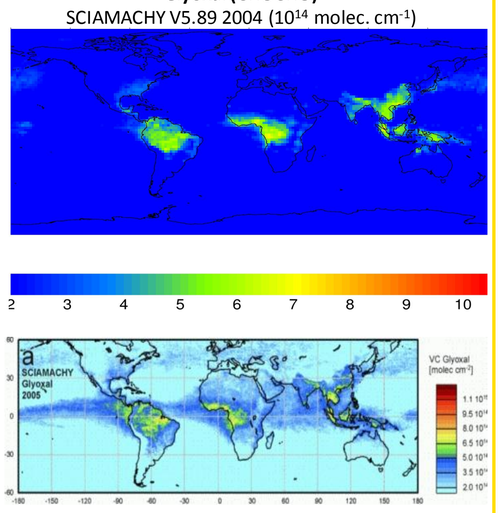
Glyoxal (CHOCHO)

SCIAMACHY V5.89 2004 (10^{14} molec. cm^{-1})

Glyoxyl, CHOCHO total columns based on UB-IUP retrieval is implemented in the operational processor and verified.

Example shows the verification of the SPG V5.89 (upper panel) with the scientific product of UB-IUP (lower panel).

Results show a very good consistency with the IUP's scientific product.



Topospheric bromine oxide, BrO columns based on BIRA-IASB retrieval scheme developed for GOME2 will be implemented in the operational processor V7.

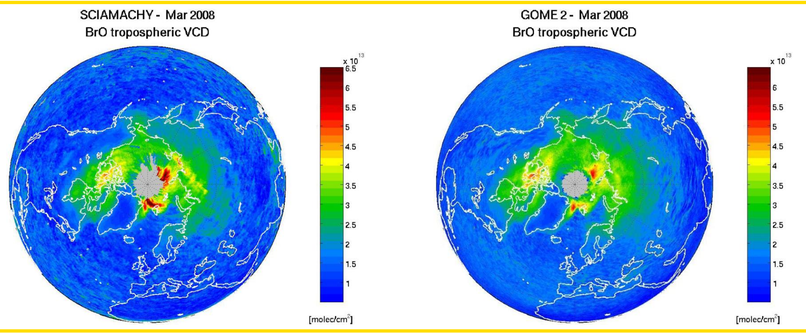
SCD: DOAS fit in 336-351.5 nm
VCDstrato : stratospheric BrO climatology using parameterization based on
1. O3 VCD (proxy of the dynamics of the stratosphere)
2. NO2 stratospheric VCD (photochemistry)

AMF: dependence on geometry, albedo, clouds,profile shapes

Example shows the comparison of the BIRA-IASB scientific SCIAMACHY product (left panel) to the GOME-2A data (right panel)

Results show overall good consistency.

Next step:
Support to implementation within SGP:
- Implementation and use of stratospheric BrO climatology.
- Calculation of VCDstrato and AMFstrato using the climatology.
- Calculation of AMFtropo.
- Calculation of VCDtropo.



Level 2 Products History and Outlook

Product Improvements Level 2	V 3.01	V 4.0	V 5.0	V 6.0	V 7.0
Verifired		March 2008	March 2009	2013/14	Spring 2016 (planned)
Baseline Delivered		June 2008	June 2009	2014	Spring 2016 (planned)
Switch (forward processing)	2007	not activated	October 2010	N/A	N/A
Release of Reprocessed Data			June 2012	2015	2017 (planned)
Nadir Products					
Absorbing Aerosol Index	quality not sufficient	improved algorithm and usage of degredation corrections	no changes	usage of calculated TC O3	Maintenance
Ozone total column evolution	slight trend over time (<0.5% per year), GDP 4	degredation correction taken into account	smaller trend	improvements w.r.t. trends expected from L7 improvements	Maintenance
Trop O3				Implementation study	Scientific Product (Operational implementation tbd 2015)
NO2	offset removed	reference spectra	no changes	Maintenance	Maintenance
Trop. NO2 columns				New product	Verification & Maintenance
BrO		SCD	VCD	Maintenance	Maintenance
Trop. BrO columns					New product
SO2		SCD, reference sector	VCD, volcanic and pollution	Maintenance	Maintenance
OClO			SCD	Maintenance	Maintenance
HCHO				New product VCD	Maintenance
CHOCHO				New product VCD	Maintenance
H2O			VCD	Maintenance	Maintenance
CO/xCO			VCD xCO quality tbc	xCO Improvements	Maintenance
xCH4				New product	Maintenance
IO					Scientific product (Operational implementation tbd 2015)
Cloud parameter evolution	OCRA/SACURA	improvements due to degradation correction	new minimum reflectance data base improved OCRA CF	Ice/snow/clouds discrimination	Maintenance
Limb Products					
Ozone profile evolution	TH offset removed, max of 4 limd O3 profiles per tangent height	Improved forward model, optimized retrieval settings => substantially smaller low bias	clouds and aerosols improvements lower stratosphere	extension to upper stratosphere and lower mesosphere	Maintenance
NO2 profile evolution	TH offset removed	Improved forward model, optimized retrieval settings => improved lower stratosphere	clouds taken into accout	Maintenance	Maintenance
BrO profile Implementation			product newly implemented	Maintenance	Maintenance
Limb clouds			flagging and cloud top height product implemented	NLC detection	clouds/aerosol discrimination
H2O				Implementation study	Scientific product (Operational implementation not planned)
Aerosols				Implementation study	Scientific product (Operational implementation not planned

Related ATMOS 2015 Posters

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M. Gottwald et al. : SCIAMACHY Operations History and the New Level 1b Product – an Approach for Long-term Data Preservation
R. Snel et al.: Improved correction for contamination-induced in-flight instrument degradation of SCIAMACHY
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D. Hubert et al. : The Multi-TASTE validation system: Tasting the evolution of reactive and greenhouse gas data products from Envisat and Third Party Missions
M. Markus et al.: Limb-Nadir Matching for Tropospheric NO_2: A New Algorithm in the SCIAMACHY Operational Level 2 Processor
G. Lichtenberg et al.: SCIAMACHY: Impact of calibration changes on SCIAMACHY CH_4 and CO retrievals
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